clEsperanto : a GPU-accelerated image processing library. `cle._`

Intership on scientific software development at Institut Pasteur, Paris.

Modern imaging and microscopy technologies currently used in Life-Sciences generate large images in vast quantities. Processing and analysing them in an acceptable time is becoming a challenge. We are building a new scientific software tools that can process and analyses images, and address efficiently the challenges brought by this deluge of data.

We are looking for a motivated student to join and help us in this project. This will involve developing a user-friendly framework for image processing that exploits GPU infrastructure to accelerate computation. More details outlined below.

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clEsperanto [1,2] is an international collaborative open-source project, that extends the custom OpenCL [3] dialect first proposed in CLIJ [4,5,6]. It aims at making GPU-accelerated image processing available to all the major languages and software used in Bio-Image Analysis, from Fiji, Icy, MATLAB and Java to Napari and Python, with a single common core. This library relies on an architecture of language-specific top-layer API wrapped around a common low-level C++ layer in charge of managing processing operations and device-host communications. Each language specific layer focuses on maintaining a common generic naming convention and usage, facilitating access, usage, and empowering interaction in between communities. Concurrently, the low-level common layer ensures identical computation regardless of the operating system or the programming language used. Altogether they improve re-usability, reproducibility, and maintainability, while drastically lowering the learning curve for using GPU-acceleration in Bio-Image Analysis research.

Joining the Image Analysis Hub [7] team of the Institut Pasteur, you will be actively participating in the development and improvement of the clEsperanto library, with the lead developer of the project.

Objectifs.

1. Participate in the development of a low-level C++ library for GPU processing.
2. Develop a C++ to Python interface.
3. Help in creating and setting-up contious integration and deployement.
4. Creation of tutorial and documentation support for the community.
5. Test and use the library on research project.
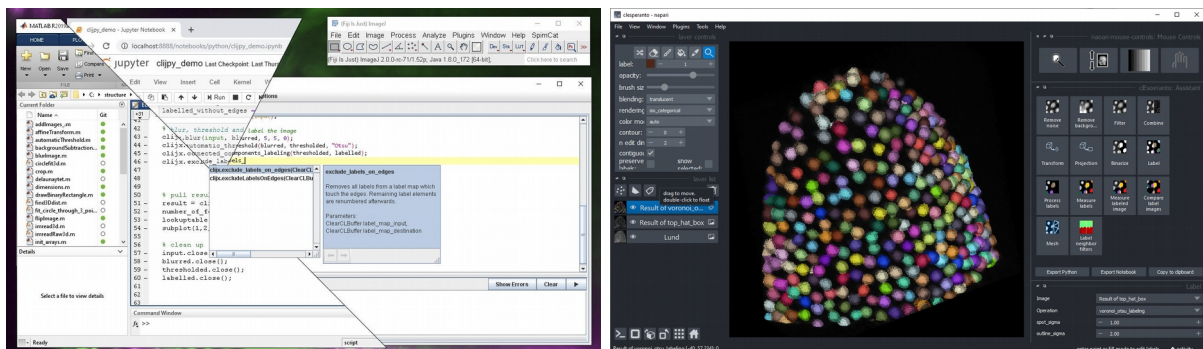
Profil.

Student in license, master, or engineering school in Computer Science, or similar and you are looking for +6 months internship or alternate formation. You are motivated in participating in an european collaborative open-source project and discover scientific research.

- Strong knowledge in C++ and Python language is required
- Good knowledge in CMake is required
- Knowledge in Software design and Pattern design is appreciated
- Knowledge in OpenCL and GPU hardware is appreciated
- Knowledge in Image Processing and Analysis is appreciated
- Capacity to communicate in English is appreciated

Workload and objectives to be adapted depending on the candidate profile.

Contact.

Interested? Send a CV and a motivation to Stéphane Rigaud (stephane.rigaud@pasteur.fr) and Jean-Yves Tinevez (jean-yves.tinevez@pasteur.fr).

References:
[1] https://clesperanto.github.io
[2] Robert Haase, Akanksha Jain, Stéphane Rigaud, Daniela Vorkel, Pradeep Rajasekhar, Theresa Suckert, Talley J. Lambert, Juan Nunez-Iglesias, Daniel P. Poole, Pavel Tomancak, Eugene W. Myers. Interactive design of GPU-accelerated Image Data Flow Graphs and cross-platform deployment using multi-lingual code generation. bioRxiv 2020.11.19.386565
[3] https://www.khronos.org/opencl/
[4] Haase, R., Royer, L.A., Steinbach, P. et al. CLIJ: GPU-accelerated image processing for everyone. Nat Methods 17, 5–6 (2020).
[5] Daniela Vorkel, Robert Haase. GPU-accelerating ImageJ Macro image processing workflows using CLIJ. (2020) arXiv:2008.11799
[6] https://clij.github.io/
[7] https://research.pasteur.fr/en/team/image-analysis-hub/